

Office of Technical Assistance Research Proposal
***Evaluation of Consumption and Loss of n-Propyl Bromide from Vapor
Degreasing Machines Relative to Trichloroethylene***

Background

Vapor degreasing is a solvent degreasing method used to remove oils, waxes, and other soils from fabricated metal parts. Vapor degreasers boil the solvent, which then condenses on the contaminant and dissolves it. Trichloroethylene (TCE) is a standard solvent used in degreasing applications. It is suitable for vapor degreasing because it has no flash point, making it safe to use in vapor degreasers, and boils at a lower temperature than oil and grease, allowing operators to recover the solvents for repeated use. While TCE is an effective degreasing solvent, it is not a favorable solvent in terms of environmental effects and worker health; the EPA has determined that TCE is a smog-forming volatile organic compound (VOC) and a toxic Hazardous Air Pollutant (HAP). TCE, which is reportable under TURA, is also a suspected carcinogen.

Scope of Problem

Table 1 displays the TURA filers for 1999 that reported the use of TCE and listed solvent degreasing in their production units. In addition to these large quantity users, it is highly probable that there are numerous smaller facilities throughout Massachusetts that use TCE for vapor degreasing in amounts below the 10,000 lbs “otherwise use” reportable threshold.

Table 1.

SIC Code	Industry	Filers	TCE Used (lbs)
3675	Electronic Capacitors	1	160,380
3471	Plating & Polishing	2	35,009
3499	Fabricated Metal Parts	3	46,903
3644	Non-current-carrying Wire Devices	1	14,542
3545	Machine Tool Accessories	1	22,885
3822	Environmental Controls	1	101,000
3479	Metal Coating & Allied Devices	1	48,083
3724	Aircraft Engine Parts	1	27,487
	Totals:	11	456,289

Developing a preferable alternative to TCE would reduce VOC emissions in Massachusetts significantly and eliminate worker exposure to a toxic chemical. It is possible that n-propyl bromide (nPB) could be a drop-in replacement for TCE in vapor degreasing if the volatility and decomposition rate of nPB can be adjusted.

Objective

The disparity in consumption and loss between the solvents during vapor degreasing can be attributed to two mechanisms: fugitive emissions and decomposition. TCE (vapor pressure of 60 mm Hg at 20 C) is less volatile than nPB (110 mm Hg), and nPB is more likely to decompose during vapor degreasing. The fugitive emissions and hydrolysis rates for each solvent should be quantified for normal reflux and moisture conditions.

Once these values have been determined, the equipment and stabilizers should be evaluated so that the necessary adjustments can be made to make nPB and TCE equivalent solvents in terms of consumption and lost solvent. The performance of current stabilizers in commercial formulations should also be evaluated. Finally, identify and evaluate a superior stabilizer that would not be lost from the system so easily and subsequently reduce the frequency of composition monitoring.

Scope of Work

OTA can help to identify an industry partner for this project.